

Appl. No. 10/827,509
Amendment dated
Reply to Office action of May 8, 2006

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claim 1 (original): A filter element for mounting in a filter housing, said filter element comprising filter media, and a support frame supporting said filter media, said support frame having a seal integrally formed therewith for sealing against said filter housing.

Claim 2 (original): The filter element according to claim 1 wherein said seal is integrally molded with said support frame.

Claim 3 (original): The filter element according to claim 1 wherein said seal is softer than said support frame.

Claim 4 (original): The filter element according to claim 3 wherein said support frame is substantially rigid.

Claim 5 (original): The filter element according to claim 1 wherein said support frame and said seal are of different materials.

Claim 6 (original): The filter element according to claim 5 wherein the material of said seal is softer than the material of said support frame.

Claim 7 (original): The filter element according to claim 6 wherein each of said materials is heat and chemical resistant, including the softer material of said seal.

Claim 8 (currently amended): The filter element according to claim 1 wherein in combination:
said support frame is an injection molded plastic member; and
said seal is an injection molded thermoplastic member,

neither said support frame nor said seal being potted.

Claim 9 (original): The filter element according to claim 1 wherein said seal is TPE.

Claim 10 (original): The filter element according to claim 1 wherein said seal is TPV.

Claim 11 (original): The filter element according to claim 1 wherein said seal is TPSiV.

Claim 12 (original): The filter element according to claim 3 wherein:

said filter element is an annular filter element extending axially along an axis between first and second axial ends, and having a hollow interior;

said support frame is an end cap at one of said axial ends, said end cap having an aperture therethrough communicating with said hollow interior;

said seal is integrally formed on said end cap for sealing against said filter housing.

Claim 13 (original): The filter element according to claim 12 wherein:

said end cap has an axially facing first annular surface circumscribing said aperture, and a radially facing second annular surface circumscribing said aperture;

said seal extends along at least one of said first and second annular surfaces and engages a portion of said filter housing facing said one annular surface, with said seal spanning between said one annular surface and said portion of said filter housing.

Claim 14 (original): The filter element according to claim 13 wherein said seal extends along both of said first and second annular surfaces of said end cap and comprises a first segment engaging a first portion of said filter housing axially facing said first annular surface of said end cap, and a second segment engaging a second portion of said filter housing radially facing said second annular surface of said end cap.

Claim 15 (original): The filter element according to claim 14 wherein both of said first and second segments have one or more deflection fingers extending therefrom and deflectingly engaging a respective said portion of said filter housing, at least one of said fingers being axially deflected, and at least another of said fingers being radially deflected, each said deflection finger forming an annular seal
5 with said filter housing.

Claim 16 (original): The filter element according to claim 13 wherein said seal extends along said first annular surface of said end cap and has a V-shape with the apex of the V at said axially facing first annular surface of said end cap, and the legs of the V diverging from said apex and engaging said filter housing at radially spaced engagement points each defining an annulus circumscribing said aperture.

Claim 17 (original): The filter element according to claim 13 wherein said seal extends along said radially facing second annular surface of said end cap and has a plurality of angled barbs extending radially and axially from said second annular surface and engaging said filter housing at axially spaced engagement points each defining an annulus circumscribing said aperture.

Claim 18 (original): The filter element according to claim 13 wherein:

said seal extends along said axially facing first annular surface of said end cap and has a V-shape with the apex of the V at said axially facing first annular surface of said end cap, and the legs of the V diverging from said apex and engaging said filter housing at a first set of engagement points
5 radially spaced from each other and defining a first set of annuli circumscribing said aperture;

said seal extends along said radially facing second annular surface of said end cap and has a plurality of angled barbs extending radially and axially from said radially facing second annular surface and engaging said filter housing at a second set of engagement points axially spaced from each other and defining a second set of annuli circumscribing said aperture.

Claim 19 (original): The filter element according to claim 12 wherein said end cap has an axially facing annular surface circumscribing said aperture, and said seal is on said axially facing annular surface of said end cap.

Claim 20 (original): The filter element according to claim 19 wherein said seal has a flat first surface on said axially facing annular surface of said end cap, and has an arcuate second surface engaging said filter housing in sealing relation along an annulus circumscribing said aperture.

Claim 21 (original): The filter element according to claim 20 wherein said seal is semi-circular in radial cross-section.

Claim 22 (original): The filter element according to claim 12 wherein said end cap has an axially facing annular surface circumscribing said aperture, and a pair of walls extending axially from said surface and separated by a radial gap therebetween, said gap defining an annular channel circumscribing said aperture, and wherein said seal is in said annular channel.

Claim 23 (currently amended): The filter element according to claim 12 wherein:

said end cap has an axially facing first annular surface circumscribing said aperture, and a radially facing second annular surface circumscribing said aperture;

5 said seal extends along both of said annular surfaces of said end cap and comprises a first segment engaging a first portion of said filter housing axially facing said first annular surface of said end cap, and a second segment engaging a second portion of said filter housing radially facing said second annular surface of said end cap;

10 said first segment of said seal extends axially beyond said first annular surface of said end cap and is tapered radially outwardly ~~from said aperture~~ away from said second segment of said seal.

Claim 24 (original): The filter element according to claim 12 wherein said end cap has a radially facing annular surface circumscribing said aperture, and said seal is on said radially facing annular surface and circumscribes said aperture.

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Claim 25 (original): The filter element according to claim 24 wherein said seal has a first arcuate surface on said radially facing annular surface of said end cap, and has a second arcuate surface engaging said filter housing along an annulus.

Claim 26 (original): The filter element according to claim 25 wherein said radially facing annular surface of said end cap is a recessed annular groove receiving said first arcuate surface of said seal therein.

Claim 27 (original): The filter element according to claim 25 wherein said radially facing annular surface of said end cap is a protruding lip receiving said first arcuate surface of said seal thereon.

Claim 28 (currently amended): The filter element according to claim 27 wherein said seal has a ~~C-shaped~~ C-shape with first and second generally parallel C-shaped surfaces, said first C-shaped surface being said first arcuate surface of said seal, said second C-shaped surface being said second arcuate surface of said seal, said first and second arcuate surfaces of said seal being generally parallel to each other.

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Claim 29 (original): The filter element according to claim 24 wherein said radially facing annular surface of said end cap faces radially inwardly.

Claim 30 (original): The filter element according to claim 24 wherein said radially facing annular surface of said end cap faces radially outwardly.

Claim 31 (original): The filter element according to claim 30 wherein said seal extends radially outwardly from said radially outwardly facing annular surface of said end cap.

Claim 32 (original): The filter element according to claim 3:
said filter element is a panel filter element lying in a plane and having a perimeter;

said support frame extends along said plane around said perimeter of said panel filter element, said plane defining a lateral dimension, said support frame having a sidewall extending
5 longitudinally along a height dimension transverse to said plane and said lateral dimension;
said seal is integrally formed on said sidewall of said support frame for sealing against filter housing.

Claim 33 (original): The filter element according to claim 32 wherein said seal extends laterally from said sidewall.

Claim 34 (original): The filter element according to claim 33 wherein said seal has an eccentric shape in lateral cross-section.

Claim 35 (original): The filter element according to claim 32 wherein said seal extends longitudinally from said sidewall.

Claim 36 (original): The filter element according to claim 35 wherein said sidewall extends longitudinally between first and second distally spaced ends, and said seal comprises a first seal on said first end and a second seal on said second end.

Claim 37 (original): The filter element according to claim 32 wherein said sidewall has a first longitudinally facing surface and a second laterally facing surface, and wherein said seal extends along both of said first and second surfaces of said sidewall.

Claim 38 (original): The filter element according to claim 37 wherein said seal extending along said second surface of said sidewall has a chevron shape.

Claim 39 (original): The filter element according to claim 32 wherein said sidewall has a first longitudinally facing surface, a second laterally facing surface, and a third longitudinally facing surface,

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said first and third surfaces being distally longitudinally spaced by said second surface therebetween, and wherein said seal extends along all three of said first, second and third surfaces.

Claim 40 (original): The filter element according to claim 39 wherein said seal extends along the entire longitudinal dimension of said sidewall and has a first portion extending longitudinally from said first surface of said sidewall, a second portion extending laterally from said second surface of said sidewall, and a third portion extending longitudinally from said third surface of said sidewall.

Claim 41 (original): The filter element according to claim 33 wherein said seal has a pair of deflection fingers longitudinally spaced from each other and laterally deflectable for sealing against said filter housing.

Claim 42 (original): The filter element according to claim 41 wherein said fingers diverge from each other in a V-shape from an apex at said sidewall, each finger extending obliquely relative to each of said longitudinal and lateral directions.

Claims 43-45 (canceled)

Claim 46 (new): The filter element according to claim 1 wherein said support frame comprises a sidewall extending longitudinally, and wherein said sidewall has a first longitudinally facing surface and a second laterally facing surface, and wherein said seal extends along both of said first and second surfaces of said sidewall.

Claim 47 (new): The filter element according to claim 1 wherein said support frame comprises a sidewall extending longitudinally, and wherein said sidewall has a first longitudinally facing surface, a second laterally facing surface, and a third longitudinally facing surface, said first and third surfaces being distally longitudinally spaced by said second surface therebetween, and wherein said seal extends along all three of said first, second and third surfaces.

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Claim 48 (new): The filter element according to claim 47 wherein said seal extends along the entire longitudinal dimension of said sidewall and has a first portion extending longitudinally from said first surface of said sidewall, a second portion extending laterally from said second surface of said sidewall, and a third portion extending longitudinally from said third surface of said sidewall.